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SUPINE TO STANDING COBB ANGLE CHANGE IN IDIOPATHIC SCOLIOSIS: THE EFFECT OF ENDPLATE PRESELECTION

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Introduction

Standing radiographs are the 'gold standard' for clinical assessment of adolescent idiopathic scoliosis (AIS), with the Cobb Angle used to measure the severity and progression of the scoliotic curve. Supine imaging modalities can provide valuable 3D information on scoliotic anatomy, however, due to changes in gravitational loading direction, the geometry of the spine alters between the supine and standing position which in turn affects the Cobb Angle measurement. Previous studies have consistently reported a 7-10° [1-3] Cobb Angle increase from supine to standing, however, none have reported the effect of endplate pre-selection and which (if any) curve parameters affect the supine to standing Cobb Angle difference.

Methods

Female AIS patients with right-sided thoracic major curves were included in the retrospective study. Clinically measured Cobb Angles from existing standing coronal radiographs and fulcrum bending radiographs [4] were compared to existing low-dose supine CT scans taken within 3 months of the reference radiograph. Reformatted coronal CT images were used to measure Cobb Angle variability with and without endplate pre-selection (end-plates selected on the radiographs used on the CT images). Inter and intra-observer measurement variability was assessed. Multi-linear regression was used to investigate whether there was a relationship between supine to standing Cobb Angle change and patient characteristics (SPSS, v.21, IBM, USA).

Results

Fifty-two patients were included, with mean age of 14.6 (SD 1.8) years; all curves were Lenke Type 1 with mean Cobb Angle on supine CT of 42° (SD 6.4°) and 52° (SD 6.7°) on standing radiographs. The mean fulcrum bending Cobb Angle for the group was 22.6° (SD 7.5°). The 10° increase from supine to standing is consistent with existing literature. Pre-selecting vertebral endplates was found to increase the Cobb Angle difference by a mean 2° (range 0-9°). Multi-linear regression revealed a statistically significant relationship between supine to standing Cobb Angle change with: fulcrum flexibility ($p=0.001$), age ($p=0.027$) and standing Cobb Angle ($p<0.001$). In patients with high fulcrum flexibility scores, the supine to standing Cobb Angle change was as great as 20°.The 95% confidence intervals for intra-observer and inter-observer measurement variability were 3.1° and 3.6°, respectively.

Conclusion

There is a statistically significant relationship between supine to standing Cobb Angle change and fulcrum flexibility. Therefore, this difference can be considered a measure of spinal flexibility. Pre-selecting vertebral endplates causes only minor changes.

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